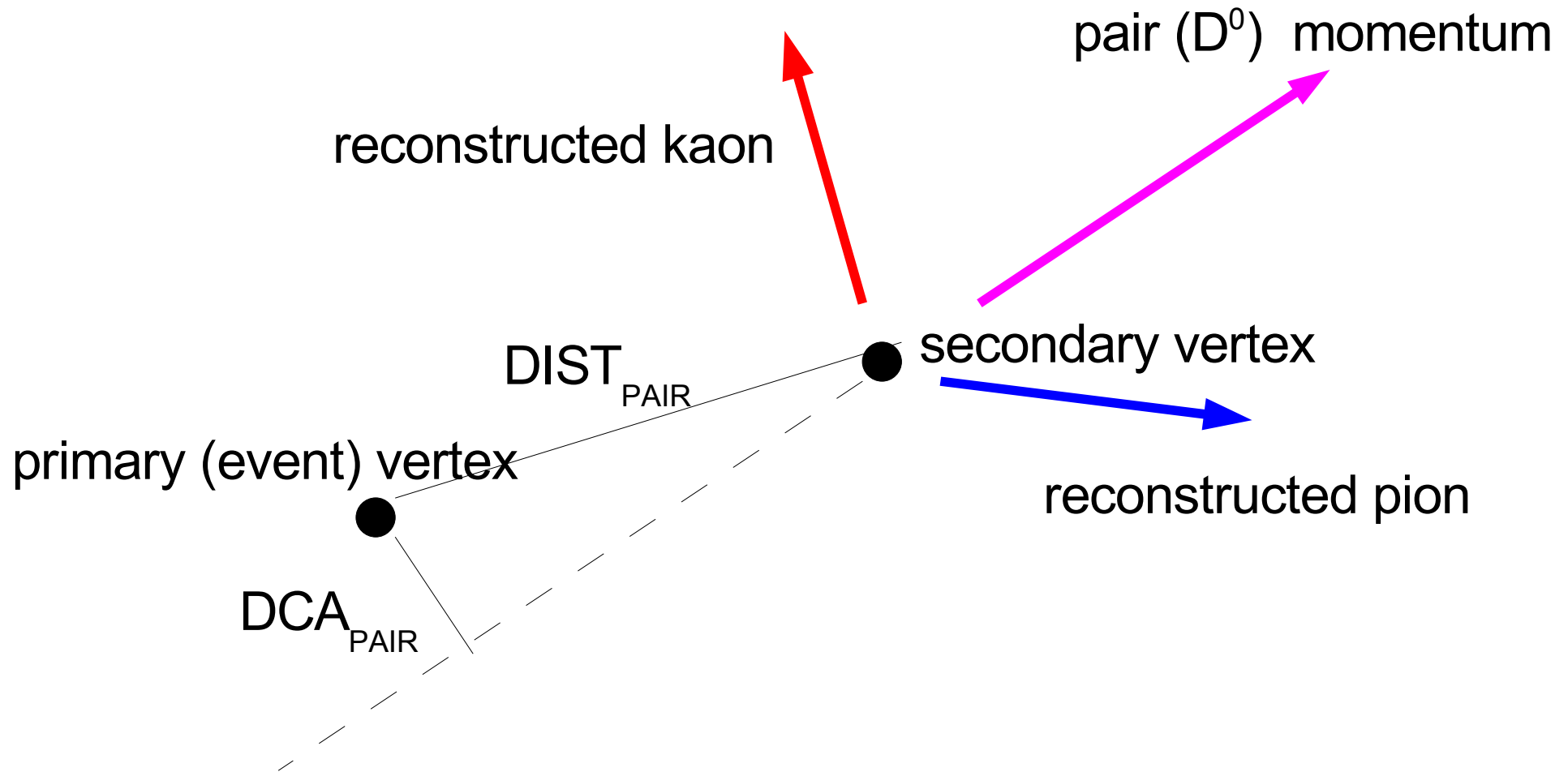


# **D<sup>0</sup> to K $\pi$ measurement using KalFit**

Sasha Lebedev, *Iowa State University*

# General idea



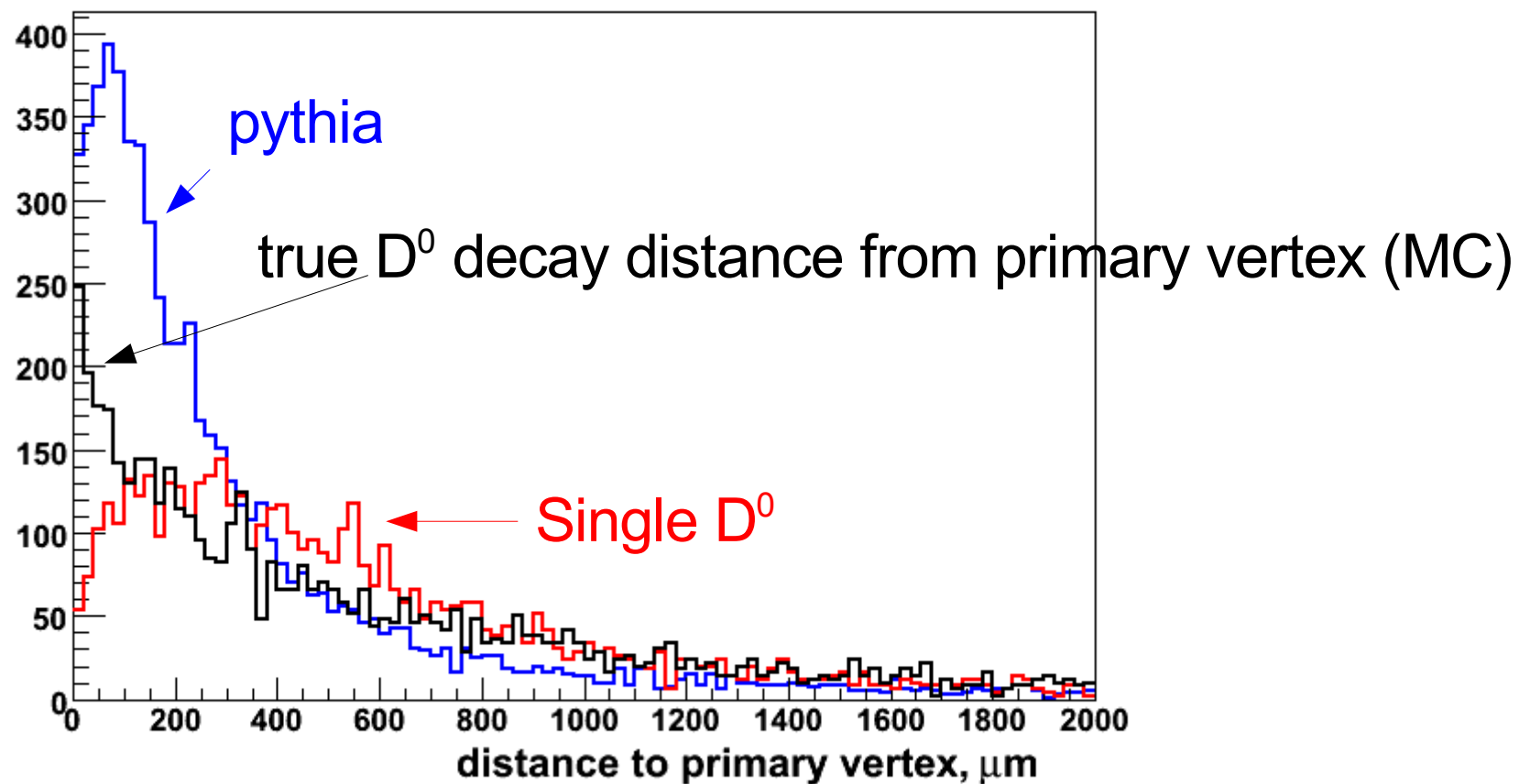
- Opposite sign tracks should cross far from primary vertex ( $DIST_{PAIR}$  large)
- Pair momentum should point to primary vertex ( $DCA_{PAIR}$  small)
- Pair momentum should point away from primary vertex

# The procedure

- Generate single  $D^0$  using pythia (signal).
- Generate pythia min. bias pp events as background.
- Run both samples through PISA and full reconstruction. Use KalFit to find secondary vertex for opposite sign pairs and momentum components at this secondary vertex (no merging, no PID).
- Calculate  $\text{DIST}_{\text{PAIR}}$  and  $\text{DCA}_{\text{PAIR}}$  assuming no magnetic field in making projections.
- Compare  $\text{DIST}_{\text{PAIR}}$  and  $\text{DCA}_{\text{PAIR}}$  distributions in signal and background samples, and make cuts in order to improve S/B ratio.

# $\text{DIST}_{\text{PAIR}}$ distribution

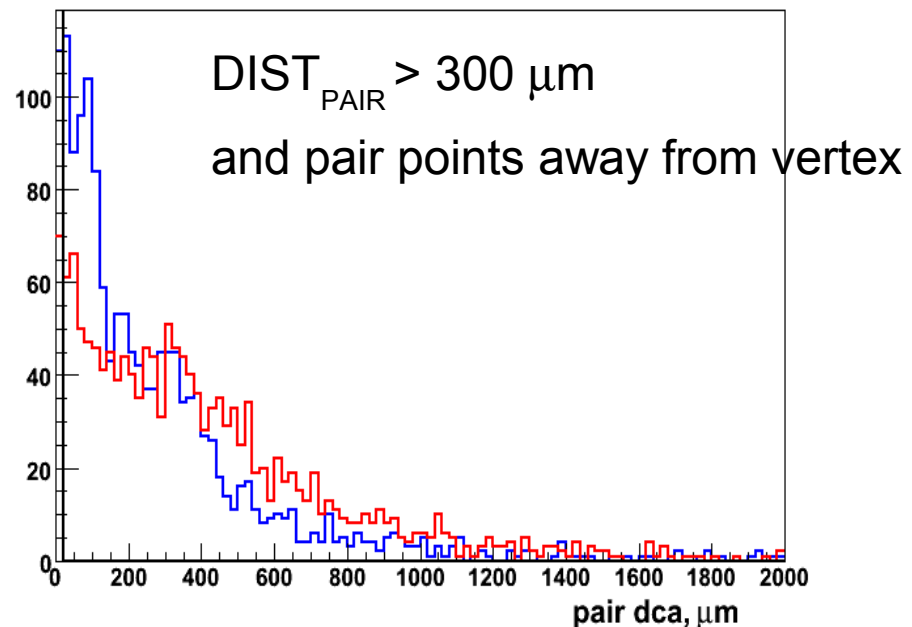
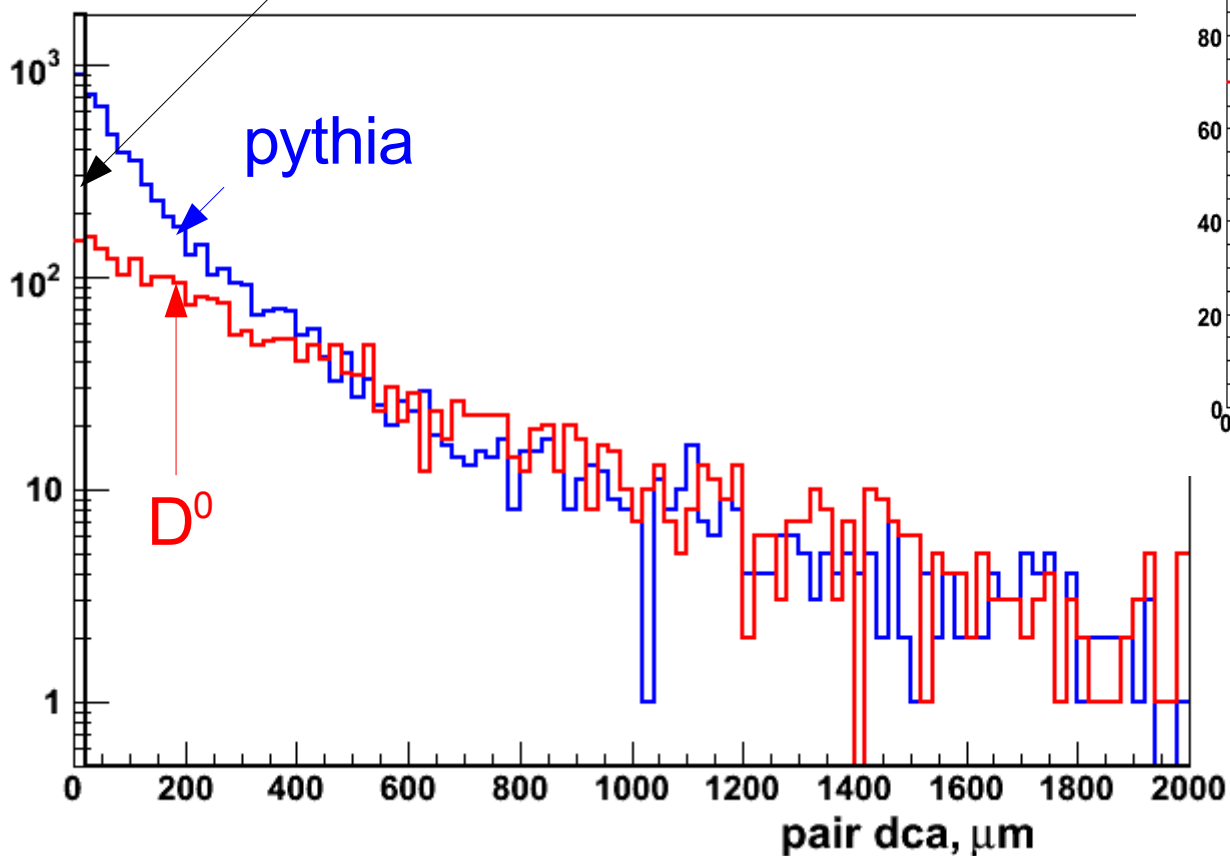
- Distributions are not normalized.
- Momentum cut 0.5 GeV (optimum for  $D^0$  studies)



# $DCA_{PAIR}$ distribution

Distributions are not normalized

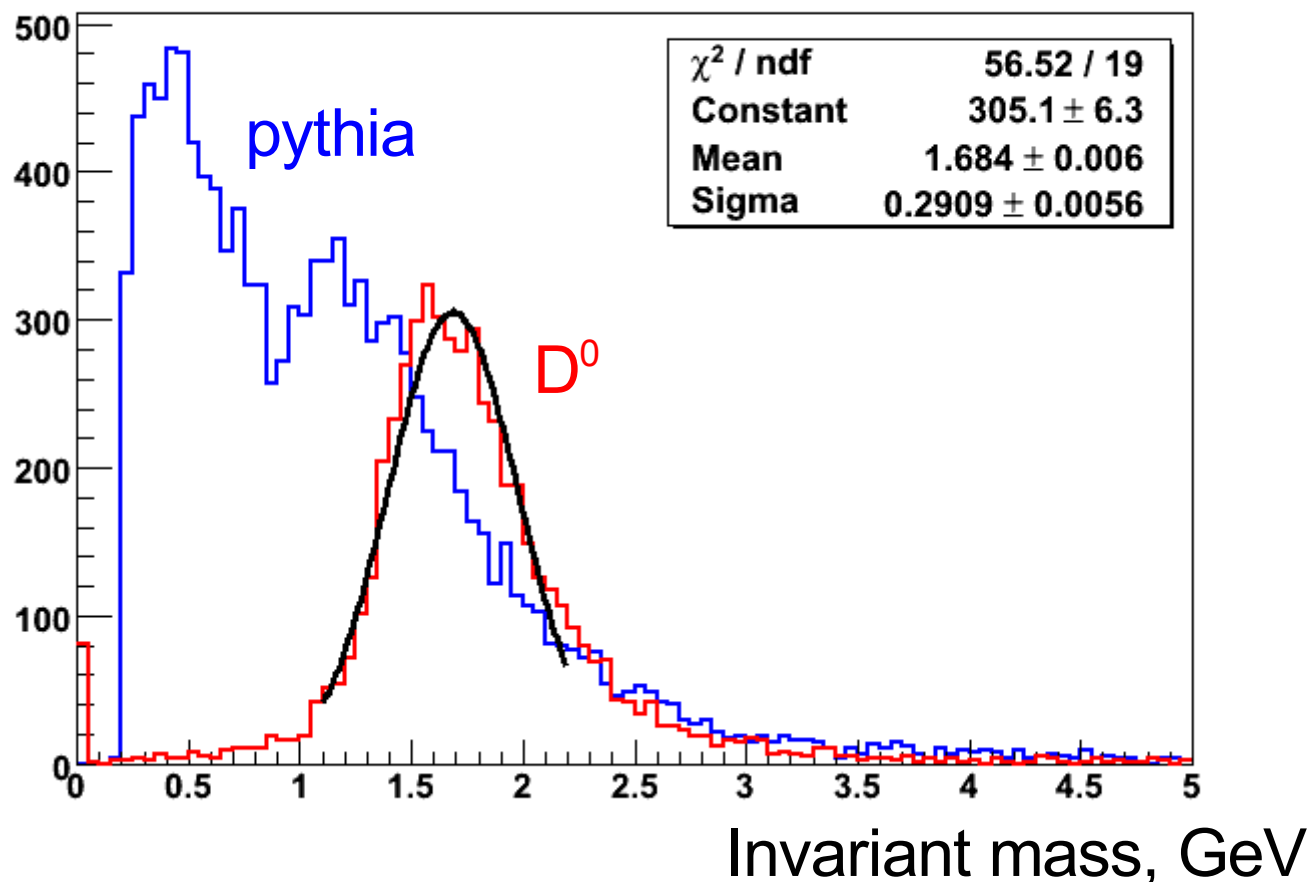
$D^0$  pair dca using MC info



$DCA_{PAIR}$  cut does not work!

# Invariant mass distribution

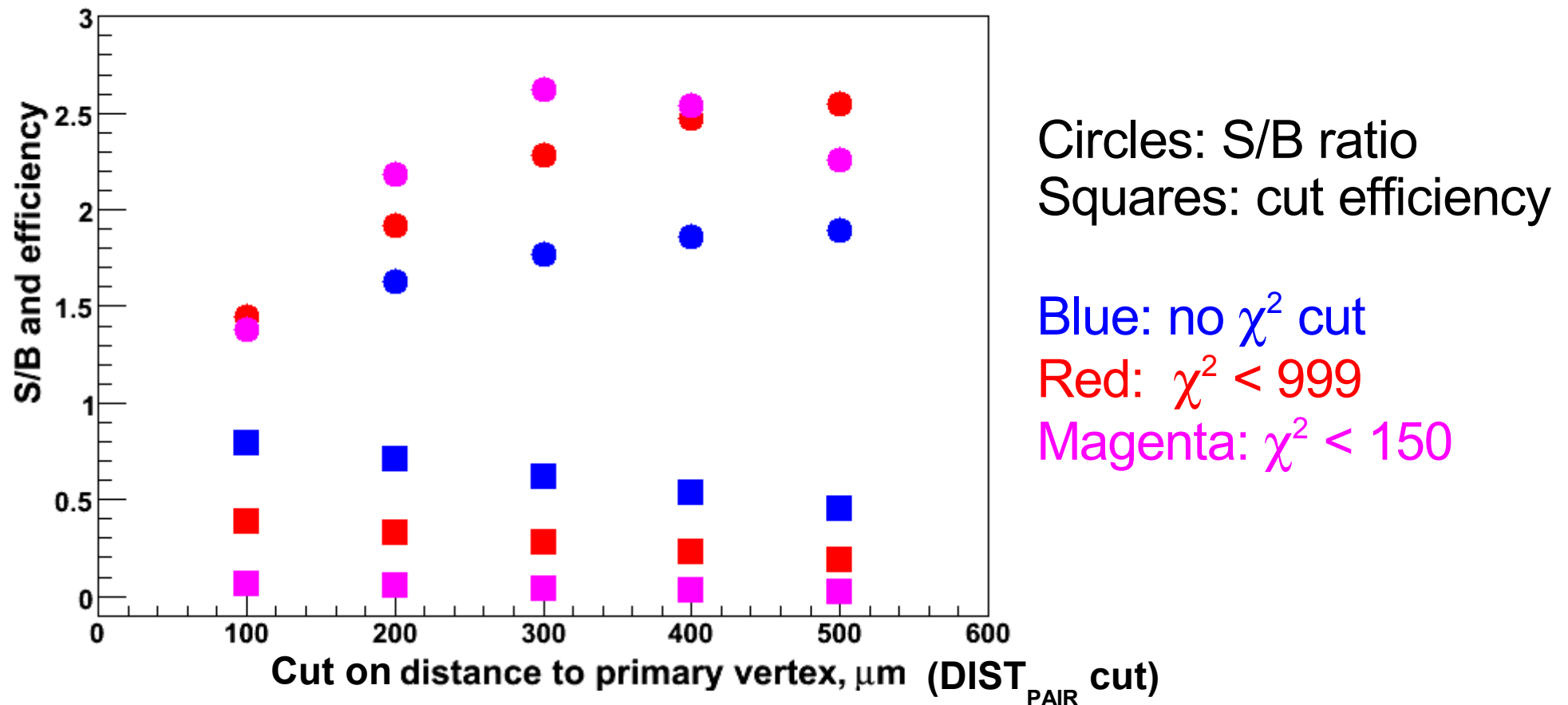
- Distributions are not normalized.
- Pion masses assumed.
- Count pairs within 2 sigma of  $D^0$  mass, calculate S/B ratio and see how it changes if various cuts are applied.



The two peaks in blue histogram are same/opposite arm

# Signal/Background ratio and efficiency

Opposite sign pairs with momentum cut 0.5 GeV each,  
and pair momentum pointing away from event vertex.



# Summary

- S/B ratio can be improved only by factor  $\sim 2.0$ - $2.5$ , but more than half of  $D^0$  will be lost. This is bad. In run 5 pp the estimate was  $\sim 650 D^0$  in PHENIX Central Arms acceptance.
- $DCA^{PAIR}$  cut does not work (maybe should not work?).
- Main reason for bad performance – bad DCA resolution at low momenta. Most particles involved in this study have momentum  $\sim 0.5$  GeV.  
Typical DCA resolution for pythia bg pairs is  $\sim 120\mu m$  with non-Gaussian tails.
- We need to improve DCA resolution at low momenta!
- Using VTX standalone can increase statistics by  $\sim 10$ .